Appendix H
SOW 6643-A-0398

TACTICAL OPERATIONAL FLIGHT TRAINER (D TOFT)

2F193B S/N 037

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Trainer Description for Device 2F193B D TOFT
Serial Number (S/N) 037

Located at

MCAS Iwakuni, Japan

1.0 TRAINER DESCRIPTION

1.1 Function and General Description:

a. The Tactical Operational Flight Trainer (TOFT) was built by L3 COMMUNICATIONS, Training Systems Inc., Arlington, Texas. The trainer is a mode selectable device that provides a realistic, interoperable, full spectrum combat training environment for Fleet Replacement Squadrons (FRS) and Fleet Combat Aircrews. The selectable modes include a single ship procedural, local area, composite force, and full theater mission rehearsal air campaign training. The TOFT is used for training in the following areas:

- Full aircraft ground and airborne systems operations
- Limited Air Combat Maneuvering (ACM)
- Air-to-Air Weapons Delivery
- Radar Imagery
- Radar Warning System Operation
- Carrier Approach and Landings
- Normal/Emergency procedures
- Air-to-Ground (A/G) Weapons Delivery with associated Sensor Video
- Targeting FLIR

TOFT trainers are built with split cockpit configuration. The front seat (pilot) is located in one cockpit and the rear seat (Weapon and Sensor Operator (WSO)) is in a separate cockpit located next to the pilot’s cockpit. TOFT 37 is configured to simulate the FA-18 C/D aircraft and can be linked to provide crew training.

b. The TOFT device consists of the following major functional systems: Host Computer System, Visual System, Ethernet Network System, Interface System, Digital Audio System (DAS), Trainee Station System, instructor/operator station (IOS), combined Mission Observation Center (MOC) or Brief/Debrief Station (BDS), Pneumatics system and a power distribution system. The equipment is contained in three major interconnected areas: Simusphere and AFT cockpit, Simusphere and Forward cockpit, and IOS, MOC/BDS.

c. The MOC functionality allows the observation of an active mission for a single aircraft federation or a multi-aircraft integrated/federation in support of team, inter-team, JTFT and BFTT. The purpose of the BDS is to facilitate the functions of briefing, debriefing and after action reviews (AAR) of missions as part of the full training environment. The MOC/BDS room contains a Video Wall, MOC Electronics Cabinet, Brief/Debrief Cabinet, Brief/Debrief Instructor Workstation, and seating for observers. The video wall consists of (4) four Quad Assembly 19-inch Liquid Crystal Displays (LCD) and three (3) 50-inch plasma displays with Smartboard. The (4) four Quad Assembly display sets repeat the displays in each of the virtual simulator cockpits. They display the virtual simulator cockpit’s Head-up Display (HUD),

Left Multipurpose Display Indicator (LMDI), Right Multipurpose Display Indicator (RMDI), and the Multipurpose Color Display (MPCD)

d. The TOFT simulates the accuracy and response of the FA-18C/D controls, instruments, flight performance and characteristics, radar system, and weapons systems. This simulation is supported by a visual display system that presents terrain, airfield, ocean surface, atmospheric phenomena, surface and air target images, and missile trails as viewed from the cockpit. An aural system generates tactical tones and environmental sounds. Instructional features include preprogrammed insertion of malfunctions, recording of carrier conditions, ejection parameters, and computer-generated voice messages.

1.2 Trainee Station:

1.2.1 The TOFT trainee stations are a reproduction of the operating environment of the actual aircraft. The flight controls, multipurpose display and control group, and instrument panel pedestal are simulated aircraft components. The console assemblies are a replica of the aircraft's except that the construction is modified to fulfill the trainer needs. The trainee compartment for the back seat is slightly different from the front seat due to F/A-18C/D pilot and WSO equipment differences.

1.2.2 Each of the trainee stations consists of two basic subsystem elements: (1) replicate cockpit and (2) visual system. TOFT 37 simulates the FA-18 C/D model aircraft.

1.2.3 The pilot trainee station cockpits encompasses the following subsystems:

a. Power-plant Systems. The F404-GE-400/404 engines of the design basis aircraft are simulated together with the related controls, control and instruments. Static and dynamic engine performance is simulated along with the associated instrument indications, fuel consumption, and sound.

b. Fuel System. The fuel system of the design basis aircraft is simulated for quantity indication, fuel available logic, weight, and center of gravity. Instructor controls are provided to vary the total fuel quantity, including drop tanks, with the range of its capacity. The instructor may freeze the fuel system, at any point during the mission.

c. Secondary Power System. The functions of the secondary power system of the design basis aircraft are simulated together with the related control, indications, and displays.

d. Electrical Power Supply System. The electrical system is simulated to the extent of cockpit indications and control and bus logic for the left and right generators, utility and emergency batteries and external ground power.

e. Hydraulic Power Supply System. The hydraulic system (HYD 1 and HYD 2) of the design basis aircraft is simulated for system control distribution logic. The normal hydraulic pressure is provided except for malfunctions.

f. Flight Control System. The flight controls of the design basis aircraft are simulated for feel and aerodynamic response.

g. Automatic Flight Control System (AFCS). Dynamic simulation of the AFCS is provided.

h. Landing Systems. Simulation of the landing gear, nose-wheel steering, brakes, launch bar, and arresting hook is provided.

i. Instruments, Indicators, and Displays. Simulation of the following equipment is provided:

(1) Heads Up Display (HUD)
(2) Left Multi-Purpose Indicator (MDI)
(3) Right Multi-Purpose Indicator (MDI)
(4) Multi-Purpose Color Display (MPCD)
(5) Up Front Control (UFC)
(6) Angle of Attack (A0A) Indexer
(7) Attitude Reference Indicator (ARI)
(8) Standby Airspeed Indicator
(9) Standby Rate-of-Climb Indicator
(l0) Standby Magnetic Compass
(11) Radar Altimeter
(l2) Cockpit Altimeter

j. Fire Detection/Extinguishing Systems. The fire detection/extinguishing system is simulated to the extent of cockpit indication and engine performance only.

k. Entrance/Egress System. Through Pneumatic controlled Visual Facet.

l. Ejection Seat. Replica of aircraft seat. Non-functional

m. Environmental Control System. Non-Functional

n. Oxygen System. Non-Functional

o. Air Data Computer. Simulated including all required inputs.

p. Communications-Navigation-Identification Equipment

(1) Intercom System. Simulation of the intercom systems permits communications between the pilot and the instructor with the instructor corresponding to a ground or ship based control agency. Control and signal processing of audio tones, which are simulated, provide for all systems in the same manner as in the design basis aircraft. In FA-18 C/D aircraft intercom system also provides for communications between pilot to WSO, IOS and WSO, WSO to pilot, and WSO to IOS.

(2) UHF Communications System (AN/ARC-182). The two receiver-transmitters (COMM1 and COMM 2) are simulated for both communications and automatic direction finder (ADF) functions. The system provides appropriated communication links between the IOS and the Trainee Station.

(3) Tactical Air Navigation (TACAN) System (AN/ARN-118). The TACAN system is simulated for relative bearing and slant range distance indication to a ground station. Station identification tones are simulated.

(4) Inertial Navigation System (AN/ASN-130). The inertial navigation system is simulated, including inertial platform orientation, signal data converter, controls and indicators, and all alignments.

(5) Backup Attitude and Navigation System. Backup attitude and navigation system is simulated.

(6) Identification System. The IFF set is simulated.

r. Mission Computer System. The TOFT uses a software emulator to replace the aircraft's mission computers. The emulator performs most of the same functions as the Mission Computers. MC1 performs processing for the aircraft built-in test (BIT), aircraft operation status monitoring, and provides backup for MC2, the tactical computer. MC2 performs processing and control/display management for air-to-air combat, air-to-ground attack, navigation, and backup for MC1.

s. Stores Jettison System. The stores jettison system is simulated to provide jettison of external stores and racks as in the aircraft.

t. Weapons Systems. Aircraft air-to-air and air-to-ground weapons are simulated including all conventional and special weapons compatible with the design basis aircraft.

1.3 Instructor Station: The instructor station is integral with the control station.

1.3.1 Control Station. The instructor groups allow an instructor to exercise control over various trainee operations through a windows operating environment. The Instructor/Operator Station (IOS) provides the instructor/operator with controls to initiate, develop, change, freeze and monitor training scenarios. The IOS console consist of seven (7) graphics CRTs, two speakers, one card reader, three ICS jack panels, two mouse units, three headset control boxes, one desktop microphone, two keyboards, one flight control stick, one speaker control box, one throttle control stick, two EPO pushbutton switches, and three instructor/operator headsets. The instructor can "FLY" an aircraft using a control stick and throttle. Additionally, the Maintenance personnel can initiate and monitor the Daily Readiness Equipment Diagnostic (DRED) from the IOS.

1.4 Computer System, Peripherals, and Interface Cabinets:

1.4.1 The Host computer system consists of six personal computers (PCs) networked together through a 24-port gigabit Ethernet switch with a controller for monitoring and debugging. The host computer provides the necessary timing and control during real-time operations. The Host Computer System consists of a Master PC, five Slave PCs, Host Controller, 24-port gigabit switch, and 48-port gigabit switch. It performs I/O operations with the other trainer systems. The host computer has several subassemblies, including several modules containing individual circuit cards and other modules containing rack-mounted units. The Master PC is a personal computer

containing two Xeon EM64T XD HT 3.8 GHz processors and 4GB RAM with two 400GB removable Hard drive, DVD/CD ROM drive, Motherboard, Video CCA, 10/100/1000 quad Ethernet CCA, 4-port serial CC and Reflective memory CCA. Slave Computer systems are basically configured the same as the Master Host Computer.

1.5 Aircraft Common Equipment: To be Determined

1.6 Power System: The trainer power distribution system controls and distributes the ac and dc power required to operate the trainer. The system is furnished with 120/208 VAC, 3-phase, 60 Hz power. Various dc voltages are required in some equipment.

1.6.1 All AC power is controlled by Power Management Module (PMM). The PMM receives the 120/208 VAC, 3-phase, 60Hz power from the facility supply. The power cabinet is designed to distribute a maximum of 300 KVA input. The phase sequence of the input power is Phase A,B,C. The power cabinet has a DMMS 300+ Solid State Digital Triple Display Multi-Function Power Monitoring System (DMMS) installed for monitoring power fluctuations. The DMMS can display the current, voltage and power consumption for the total system as well as each phase or between phases.

1.6.2 The dc power required to operate the trainer is furnished through dc power supplies located in the AIC and IOS cabinets. The various power supplies generate +5, +/-10,+/-15,+24 and +28Vdc.

1.7 Visual System: Semisphere Visual System

1.7.1 The visual system is the same for both cockpits with the exception of the virtual head up display (HUD) and improved Fresnel lens optical landing system (IFOLS) projectors located in the pilots' cockpit. The visual system consists of nine (9) facets and eleven (11) visual projectors, nine (9) out-the-window (OTW), one (1) head up display (HUD), and one (1) improved Fresnel lens optical landing system (IFLOLS) type Electrohome Marquee 9500LC. The visual system displays the out-the-window (OTW) visual scenes to support the student training. Scenes are generated via modeled databases stored in the IG combined with simulated on-ground and in-flight inputs from the student pilot interfacing with cockpit controls. The field of view (FOV) for each of the OTW channels is software controllable to match the applicable projection system. Visual system provides a continuous FOV that extends 360 degree in a horizontal plane at 0 degrees elevation and 20 degrees down and 45 degrees up in vertical plane at 0 degree azimuth and 45 degrees down and 20 degrees up at +/-60 degrees azimuth as limited by the fuselage. The Visual System includes visual and radar databases, Image Generator, Head Tracker, virtual head up display (HUD), eleven (11) rear projection display channels, and cabling. The rear projection systems consist of the following: one facet each on the left and right forward, left and right aft, left and right upper forward, upper aft and directly aft which include projector, screen, mirror, and framework; one center system forward of the cockpit which includes projector, pedestal, screen, and one virtual head up display system including a projector and pedestal, which projects the head up display (HUD) on the center facet.

1.7.2 SimuView Image Generator (IG). There is a SimuView IG for each trainee compartment. The pilot IG consists of four OTW cabinets and one SENSOR-IG cabinet containing a group of personal computers networked together

and the required supporting hardware to provide high speed real-time graphics scenes for training. The WSO IG consists of three OTW cabinets identical to the pilot IG with the exception of the IFLOLS PC, which is not installed. The major items contained in the SimuView IG are:

1. Master Cabinet which contains Master control processor (MPC), Channel 1-3 Video Combiner, 24 Port gigabit Ethernet switch, 16-post gigabit switch, Channel 1-3 render Nodes 1-4, Pager Node, and ISECT 1 Node.
2. Cabinet 2 containing IFLOLS Node, Channels 4-6 render Nodes 1-4, 24-Port gigabit Ethernet Switch, Channels 4-6 Video Combiner and Video amplifier chassis.
3. Cabinet 3 Containing Channel 7-9 Video Combiner, 24-port gigabit Ethernet Switch, Channel 7-9 render nodes 1-4.
4. Cabinet 4 contains Pager nodes #2 and #3, MPC #2 and #3 Sensor Node, Sensor nodes #1 &#2, AGL/IR node, ISECT node 2 and 3, Controller Node, MPC #3 Node (HUD,IOS), HUD Node, IOS node, ISECT node #3, 24 gigabit Ethernet switch and amplifier chassis.
5. Cabinet 5 contains Scan converter, Synchromaster, Matrix switcher, Controller node, SVRS 2 encoder, UPS, Ethernet switch and amplifier chassis.

1.7.3 Head Tracker. A head tracker system provides head motion compensation for the overall visual scene. The visual system provides a function referred to as "Virtual Vignette" which provides head motion compensation so that the overall visual scene perspective due to head motion is correct for both close and distant scene elements. The head tracker transmits and receives information to/from the IG. This information is then transmitted from the IG to the host computer. Using the information received from pilot head position, the host computer performs calculations that shift the eye-point position data to the IG as a function of the pilot's head position. The effect provides an element of realism that duplicates looking out of an aircraft as opposed to viewing an image on a screen positioned 40 inches from the viewer's eye-point.

1.7.4 Visual Mirror. Visual Mirror assemblies have five flat glass and three Mylar mirror assemblies with alignment projectors mounted on them. The three Mylar mirrors are attached to the top of the visual display. They are used to reflect the images on the applicable screen.

1.7.5 Visual Projectors. The projectors are Marquee 9500LC electromagnetically focused devices using latest technology to provide a simply maintained system incorporating automatic convergence. Each projector contains 3 lens assemblies (red, green, and blue) with the exception of the HUD projector which has 3 green tubes installed.

1.8 Digital Audio System. The purpose of the digital audio system (DAS) is to produce, mix, control, and distribute all the Intercommunications System (ICS) and Aural audio signals used in the various parts of the trainer; specifically the cockpit and IOS stations. The major component of the DAS is the digital audio communication system (DACS) manufactured by Advanced Simulation Technology, inc. (ASTi).

1.8.1 Telestra Computer. The Telestra computer is a Linux-based platform that hoses a number of ASTi software applications. There are three dedicated Ethernet connections of connectivity to the host and the two networks. The host computer connects to the Telestra computer through the SUN

via the first Ethernet interface. The Telestra computer then processes the host computer data for the data that produces required tactical/voice (ICS) and environmental (aural) sounds and controls the DACS through the second Ethernet interface. The third Ethernet interface card is used during the HLA mode for transferring data to the other training device via the Ethernet switch.

1.8.2 DACS. The DACS contains an Ethernet interface module, a Pentium-based 800 MHz processor module with 32 MB RAM and onboard Ethernet interface, two 8-channel waveform synthesizers, removable 80 GB hard drive and floppy drive. The host computer through the Telestra controls the DACS.

1.9 Motion System: N/A

1.10 Air Conditioning System: N/A

1.11 Motor Generator Sets: N/A

1.12 Hydraulic System: N/A

1.13 Pneumatic System: The Pneumatics System consists of an air compressor canopy switch, open/close box, open/close solenoid valve, pressure release solenoid valve and air cylinder.

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2.0 Illustrations:

The following listing is for informational purposes only. Complete lists of illustrations are available at each training device location.

a. Figure 1: Artist's Conception of Device 2F193B TOFT
b. Figure 2: Typical Floor Plan of Device 2F193B TOFT
c. Figure 3: Typical Trainee Station of Device 2F193B TOFT
d. Figure 4: Typical Instructor Station of Device 2F193B TOFT

3.0 Mission Essential Subsystem Matrix:

Not Applicable

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4.0 CONTRACTED TRAINING TIME

Training Operations shall be provided in each FY as per exercised contract CLIN/SLIN per device from one of the stair steps below:

2F193B-37 F/A-18 TOFT **Contracted Training Time (CTT) Monday thru Friday (M-F)** **MCAS Iwakuni, Japan**		
Hours per Week (HPW)	**Start Time (local) (Notional)**	**End Time (local) (Notional)**
15	0900	1200
25	0800	1300
40	0800	1600
Remark(s) / Note(s)		
1-CTT time represents continuous hours of device operational training availability from initial START time. 2-CTT does not include weekend (Saturdays/Sundays) training, and no weekend training planned. 3-CTT daily Start Times are notional and may vary/shift with coordination and direction from the Contracting Officer's Representative (COR)/site scheduling authority and may change during the course of the Task Order. (Refer to Addendum A, paragraph 4.3.1). 4-CTT may be shifted between devices with coordination and direction from the Contracting Officer's Representative (COR) and Contractor Site Manager. 5- Historically the trainer is utilized no more than 8 hours in a training day; however the Government reserves the right to transfer training hours to device 2F201-16 as long as total does not exceed combined CTTs		
Table 4.1		

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5.1 Aircraft Common Equipment (ACE)

Complete list of ACE can be found in the inventory list provided at each site.

The Material Support Package (MSP) inventory of this solicitation will be determined by the results of CDRL A005 “COMS/CMS CONTRACTOR INVENTORY/UTILIZATION REPORT OF GFP/GFI”. The results of the transition inventory will be verified and signed by the site COR prior to Contractor’s submission of CDRL A002 to the Government.

NOTE: Whenever minor configuration changes, calibration or adjustment of aircraft common equipment is required for use in the trainer, such information shall be provided in this Appendix.

5.2 Trainer Equipment. Depot level (D-level) maintenance for the following trainer equipment is the responsibility of the government.

Complete list of D-level trainer equipment will be provided at each site.

5.2.1 Trainer Support Package (TSP): Includes Tools/Support Equipment, Spare Parts, Technical Data Support Package, and Software Support Material. The formal inventory (i.e. tools/support equipment, spare parts, technical data support package, and software support material, etc.) shall be those items identified during the mobilization period and stated in the yearly Inventory/Utilization Data Report. The Contractor shall comply with the development, maintenance and submission requirements for this report, as stated in the applicable CDRL item."

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6.1 PARTIAL MISSION CAPABILITY STANDARD

NOTE: Partial Mission Capability (PMC) is the material condition of a training device that cannot perform all of its missions.

PARTIAL MISSION CAPABLE LISTING
DEVICE 2F193B TACTICAL OPERATIONAL FLIGHT TRAINER (TOFT)

FAILED EQUIPMENT	%DEGRADATION
1. TRAINEE STATION	
A. COCKPIT SYSTEM	
1. COCKPIT RACK (AIC)	50
2. AIRCRAFT ELECTRICAL SYSTEM	20
3. ANGLE OF ATTACK	20
4. ARRESTING HOOK	10
5. AUTO THROTTLE CONTROL (ATC)	10
6. AURAL	20
7. AUXILIARY POWER UNIT (APU)	10
8. BRAKES	10
9. DIGITAL VOICE	30
10. FIRE/EXTINGUISH SYSTEM	10
11. FUEL QUANTITY SYSTEM	20
12. LANDING GEAR SYSTEM	10
13. LAUNCH BAR	10
14. MASTER ARM PANEL	30
15. NOSE WHEEL STEERING	20
16. SIMULATED INSTRUMENT	10
17. WARNING/CAUTION ADVISORY SYSTEM	20
18. WEAPONS RELEASE/STORES JETTISON	30
19. FLIGHT CONTROL SYSTEM (FCS)	30
20. COCKPIT LIGHTING	20
21. MDI SIMULATED	50
22. MPCD SIMULATED	40
23. UFC SIMULATED	40
24. HUD SIMULATED	40
25. HEAD TRACKER SYSTEM	30
B. COMM/NAV/RADAR/WEAPONS	
1. AUTOMATIC CARRIER LANDING SYSTEM (ACLS)	10
2. AUTOMATIC DIRECTION FINDER (ADF)	10

FAILED EQUIPMENT	%DEGRADATION
1. COMM 1 OR COMM 2	20
2. GLOBAL POSITIONING SYSTEM (GPS)	20
3. GROUND PROXIMITY WARNING SYSTEM (GPWS)	20
4. COMBINED INTERAGATOR TRANSPONDER (CIT)	10
5. INERTIAL NAVIGATION SYSTEM	20
6. INSTRUMENT LANDING SYSTEM	10
7. MAP SYSTEM (SIMULATED)	20
8. RADAR ALTIMETER	30
9. TACTICAL AIR NAVIGATION (TACAN)	20
10. UPFRONT CONTROL INTRFC	20
11. AUTOPILOT	10
12. DATA LINK	20
13. VOICE ALERT	30
14. A/A RADAR	40
15. A/G RADAR	40
16. NAVFLIR	20
17. TARGETING FLIR	30
18. RADAR WARNING RECEIVER	10
19. DECEPTIVE ELECTRONICS COUNTERMEASURES	10
20. COUNTERMEASURES DISPENSERS	10
21. SMART WEAPONS (BOMBS/MISSILES)	20
22. CONVENTIONAL WEAPONS (BOMBS/GUNS/MISSILES)	20
23. LASER DESIGNATOR TRACKER	10

C. INSTRUCTOR CONSOLE (INSTRUCTOR/OPERATOR STATION)

1. INSTRUCTOR CONSOLE EQUIPMENT (ICE)	20
2. IOS PRINTER UNIT	10
3. HUD/OTW REPEATER	30
4. COCKPIT REPEATER	30
5. INTERACTIVE DISPLAY	40
6. DATA ENTRY SYSTEM-mouse	40
7. DATA ENTRY SYSTEM -KEYBOARD	20
8. INSTRUCTOR'S A/C CONTROLS (STICK/THROTTLE/)	10
9. AUDIO SYSTEM (HEADSETS/MICROPHONE/SPEAKERS)	40

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PARTIAL MISSION CAPABILITY
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CONTINUED

FAILED EQUIPMENT	% DEGRADATION
D. VISUAL SYSTEM	
1. PROJECTOR (+/- 45 degrees from 0)	30
2. PROJECTOR (+/-45 to 120 from 0)	30
3. PROJECTOR (+/- 120-180 0 deg ,)	20
4. OVERLAY PROJECTOR (HUD)	50
E. AIRCRAFT SYSTEMS INTERFACE CABINET (AIC)	
1. ELECTRONIC CONTROL INTERFACE (EIC)	20
2. VME INPUT/OUTPUT CHASSIS	20
3. DIGITAL AUDIO SYSTEM (DAS)	30
F. COMPUTER/PERIPHERALS	
1. HOST COMPUTER	100
2. IMAGE GENERATOR COMPUTER (SGI ONYX II IG)	60
3. AIRCRAFT INTERFACE CABINET (AIC)	30
4. MAINTENANCE SYSTEM CONSOLE	10
5. INSTRUCTOR/OPERATOR SYSTEMS CABINET	30
H. POWER DISTRIBUTION SYSTEM	
1. MAIN POWER DISTRIBUTION UNIT	70

7.0 **FLOOR PLANS AND PROJECTED ADDITIONS** A complete list of floor plans and projected additions are available at each training device location.

8.0 **JANITORIAL SCHEDULING REQUIREMENTS** See Appendix AA